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ABSTRACT

Two studies were conducted to examine the efficacy of direct measurement, standardized achievement tests, and aptitude-achievement discrepancy scores in distinguishing learning disabled (LD) and nonlearning disabled (NLD) students in grades 3 to 6. For both reading (Study I) and written expression (Study II), students' scores on direct and repeated measures (Words in Isolation and Oral Reading) predicted their classification as LD or NLD as well as commercial measures of achievement (Stanford Diagnostic Reading Test, the Peabody Individual Achievement Test, and the Test of Written Language) and aptitude-achievement discrepancy (the Woodcock-Johnson Psycho-Educational Battery). However, the direct measures required significantly smaller expenditures, both in terms of cost and time. The additional benefit was the use of direct, repeated measures to obtain common data bases across decisions affording continuity between information collected during assessment and the information needed to evaluate instruction. (Author/PN)

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Research Report No. 104

PREDICTIVE EFFICIENCY OF DIRECT, REPEATED MEASUREMENT: AN ANALYSIS OF COST AND ACCURACY IN CLASSIFICATION

Doug Marston, Gerald Tindal, and Stanley L. Deno

U.S. DEPARTMENT OF EDUCATION
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Abstract

Two studies were conducted to examine the efficacy of direct measurement, standardized achievement tests, and aptitude-achievement discrepancy scores in distinguishing learning disabled (LD) and non-learning disabled (NLD) students. For both reading (Study I) and written expression (Study II), students' scores on direct and repeated measures predicted their classification as LD or NLD as well as commercial measures of achievement and aptitude-achievement discrepancy. However, the direct measures required significantly smaller expenditures, both in terms of cost and time. The additional benefit of the use of direct, repeated measures to obtain common data bases across decisions also is discussed.

Predictive Efficiency of Direct, Repeated Measurement:
An Analysis of Cost and Accuracy in Classification

At a recent national symposium, participants expressed substantial concern about the amount of testing done by school psychologists (Peterson, 1981). Indeed, in a recent survey, school psychologists estimated that they spend about 70% of their time engaged in assessment activities (Goldwasser, Meyers, Christenson, & Graden, 1982). The rate is alarming given the many limitations of test-based assessment. Arter and Jenkins (1979), for example, found that most tests measuring perceptual-motor skills and psycholinguistic functioning possessed low validity and reliability. In addition, they found little evidence to support the use of the tests in developing remedial programs for students with handicapping conditions.

Problems with test-based assessment do not exist only in perceptual-motor and psycholinguistic tests. Use of popular standardized tests of intelligence and achievement for assessment also has been criticized because of the poor technical adequacy of many devices (Salvia & Ysseldyke, 1981). Diagnosing learning difficulties on the basis of discrepancy scores from these tests is also problematic (Salvia & Clark, 1973; Algozzine, Ysseldyke, & Shinn, in press). Perhaps the most provocative data come from surveys of how school psychologists and teachers view the instructional usefulness of standardized tests (Thurlow & Ysseldyke, 1982). Approximately 80% of surveyed school psychologists reported that they believe the standardized tests they administer are educationally relevant. However, only 30% of surveyed teachers indicated that these measures give them information useful in their instructional planning.

As a result of these assessment-related problems, school psychologists find their activities criticized. Keogh (1972) observed that the school psychologists' diagnostic contribution was limited, and argued that "a somewhat different model of school psychology be adopted if services to exceptional children are to be effective" (p. 144).

One possible alternative model is the use of direct, repeated measurement of academic skills (Lovitt, 1967; White & Haring, 1980). The advantages of this methodology are two-fold. First, the data are related directly to instruction, a quality that many standardized tests do not possess (Bersoff, 1973; Goldstein, Arkell, Ashcroft, Hurley, & Lilly, 1975). Second, the measures are time efficient and may be administered by both school psychologists and teachers. This is an important characteristic considering the amount of time psychologists are using for assessment. Tractman (1981), for example, talks about a role change for the school psychologist, where he or she is an "enabler" who moves beyond the role of tester and works closely with teachers in the classroom. New concepts such as these, however, will be difficult to implement given the previously cited 70% of school psychologist time devoted to testing.

While direct, continuous measurement originally was developed for measuring pupil progress, it may be useful in making student placement decisions (Jenkins, Deno, & Mirkin, 1979). Mirkin, Marston, and Deno (1982) found that students referred by direct measurement procedures and students referred by teachers did not differ in performance on standardized tests of intelligence and achievement. Shinn, Ysseldyke,

Deno, and Tindal (1982) demonstrated that standardized tests did not significantly discriminate between learning disabled and low-achieving students whereas direct measurement of academic skills did successfully differentiate the two groups.

The purpose of the research presented here was to continue the comparison of the utility of traditional, commercially available standardized tests with direct measurement. For the academic areas of reading and written expression, discriminant analysis techniques were used to investigate the efficacy of both approaches to classifying students accurately as learning disabled (LD) or not learning disabled (NLD). Specifically, canonical correlations and classification coefficients derived from discriminant analysis were used to compare the direct measurement procedures with traditional measurement procedures.

Two studies were conducted, one in the area of reading and one in the area of written language. In each study, the efficacy of direct measurement, standardized tests of achievement, and aptitude-achievement discrepancy scores in distinguishing learning disabled and non-learning disabled students was examined by discriminant analyses.

Study I - Reading

Study I contrasted the performance of LD and NLD students on direct measures and standardized tests of reading.

Method

Subjects. Forty-three (M = 22, F = 21) regular program students and 23 (M = 19, F = 4) LD students participated in this study. The grade placement level of these 66 children ranged from first through

sixth grades. Their ages ranged from 78 months to 156 months, with a median of 112 months. The subjects were from three Minneapolis inner city schools.

In order to examine how well aptitude-achievement difference scores in reading discriminated between LD and NLD groups, a second sample of 65 students was studied. These students were enrolled in grades 3-6 in three Midwestern elementary schools. All students had been referred for special education; 25 were placed in LD services. The remaining 40 students were not eligible for special education services; these students made up the non-learning disabled (NLD) group.

Standardized commercial tests. The achievement measures in reading included two published tests, the Stanford Diagnostic Reading Test (SDRT; Karlsen, Madden, & Gardner, 1975), Subtest Five, Part A (Reading Comprehension and Phonetic Analysis) of Form B and the Reading Comprehension subtest from the Peabody Individual Achievement Test (PIAT; Dunn & Markwardt, 1970). The aptitude-achievement discrepancy scores for reading were derived from scores obtained on the Woodcock-Johnson Psycho-Educational Battery (Woodcock & Johnson, 1978).

Direct measures of reading. Two direct measures of reading were used. The Words in Isolation measure consisted of three alternative forms of 60 words each that were randomly selected by grade level from the Core List of 5,167 words listed in Basic Elementary Reading Vocabulary (Harris & Jacobson, 1972). Each 60-word list consisted of 10 words from each of the six grade levels. Words were included on

the word lists only if they had a frequency index of more than 10 per million words in the Teacher's Wordbook of 10,000 Words (Thorndike & Lorge, 1944). After a pool of 60 words was obtained for each list, the words were typed in 12 rows with five words in each row. For the Words in Isolation measure the mean number of words read correctly in one minute was the dependent variable.

The Oral Reading measure included three passages of 300 words each. These were selected from three third grade basal readers, (Allyn-Bacon, Ginn 720, Houghton-Mifflin) and each was typed on a sheet of paper. Each passage consisted of the first part of a story. The reading levels for the passages were computed using the Fry Readability Index formula (Fry, 1968) and each was at the third grade level. For this measure, the mean number of words read correct in one minute was the dependent variable.

Results

The mean reading performance on the various measures for the LD and NLD groups is presented in Table 1. The means of the LD students were lower than those of the NLD students on both the direct measures and the commercial tests. The discrepancy scores of the LD students and the NLD students were similar.

Insert Table 1 about here

The results of the discriminant analysis are shown in Table 2. For the direct measures of reading, the number of words read correctly from the word lists and basal passages were entered into the analysis.

The canonical correlation between the direct measures and LD-NLD criterion was .63. Using the derived discriminant function, 83% of all cases could be correctly classified. For the standardized tests of reading achievement (SDRT and PIAT), the canonical correlation was .70, with 86% of the cases correctly classified. The Woodcock-Johnson Aptitude-Achievement Discrepancy score for reading did not correlate highly with the criterion; the canonical correlation was .07. Thus, cases correctly classified as LD or NLD by discrepancy scores was only 62%.

Insert Table 2 about here

A further breakdown of LD and NLD students classified correctly and incorrectly is presented in Table 3. Hit rates and percentages of false positives were similar for the direct measures and the standardized achievement tests. The discrepancy scores for reading, however, provided little information for classification purposes.

Insert Table 3 about here

Study II - Written Expression

Study II compared the classification of LD and NLD students with performance on direct measures and standardized tests of written language.

Subjects

Eighty-two children were selected randomly from five elementary

schools in the Twin Cities area. The 42 males and 40 females were in grades 3-6 and ranged in age from 7 to 11 years old. Thirty-one of these children were in learning disability resource programs.

Subjects included in the examination of the aptitude-achievement discrepancies for written language were the same as those included in the reading discrepancy analysis.

Standardized commercial tests. The Test of Written Language (TOWL), developed by Hammill and Larsen (1978), was used to measure written expression. The TOWL consists of five subtests: Vocabulary, Thematic Maturity, Spelling, Word Usage, and Style. The scores obtained from the TOWL and used for analysis were scaled scores.

Direct measures of written expression. Following guidelines set up by Deno, Marston, and Mirkin (1982), each student was asked to write a composition after they were presented a story starter. At the end of five minutes, each composition was scored for Total Words Written, Words Spelled Correctly, and Correct Letter Sequences (White & Haring, 1980).

Results

Means and standard deviations for the written language measures are presented in Table 4. On all direct measures and published measures of achievement, the mean score of LD students was lower than that of NLD students. The mean discrepancy score was greater for LD students than for NLD students.

Insert Table 4 about here

Discriminant analysis was used to examine combinations of direct measures and standardized achievement tests in predicting group membership. These results are shown in Table 5. For the direct measures of written expression, Total Words, Words Spelled Correct, and Correct Letter Sequences were entered into the analysis. The resulting discriminant function produced a canonical correlation of .52, with 73% of the cases correctly classified. For the standardized achievement tests measuring written expression the subtests of the Test of Written Language were entered into the discriminant analysis. The resulting function correlated .68 with the criterion and correctly classified 80% of the cases. Investigation of the predictive efficiency of discrepancy scores focused on the Woodcock-Johnson Aptitude-Achievement difference scores. Canonical correlation for this index was .43, with 74% of the students placed correctly.

Insert Table 5 about here

A more detailed analysis of the percentage of correct classifications is presented in Table 6. Hit rates ranged from 43% to 93%, while false positives ranged from 7% to 57%. In contrast to reading discrepancy scores, the written language expression discrepancy scores were similar in their accuracy of classification to both the direct measures and the standardized tests.

Insert Table 6 about here

Discussion

Direct and repeated measurement procedures initially were designed for use in monitoring student progress in resource programs (Jenkins et al., 1979). However, educators face numerous assessment decisions in addition to program monitoring: screening, identification, instructional planning, and exit from service. Typically, the data gathered for these other decision areas come from commercially available standardized tests. The research presented here supports the notion that direct and repeated measurement also may be used for making screening and identification decisions. In our attempt to differentiate school-classified LD and NLD students in reading and written expression, we found that direct, repeated measurement predicted student eligibility as effectively as commercial measures of achievement and aptitude-achievement discrepancy.

Given that direct, repeated measurement is the most satisfactory method of measuring student progress on IEP goals, the benefit of using the same assessment approach for screening, identification, and exit criteria becomes apparent. First, the difference in cost and efficiency of making these decisions among the various approaches is significant. The materials used for direct, repeated measurement were produced at minimal cost and required only a few minutes to administer. On the other hand, the published tests used were all quite expensive and required a far greater amount of time to administer. For example, at least one hour is required to administer the PIAT and over two hours is needed to administer the aptitude and achievement sections of the Woodcock-Johnson Psycho-Educational

Battery. Thus, the notion that direct and repeated measures have "predictive efficiency" is suggested.

A second, and more important, advantage of direct, repeated measures is the development of a common data base across decision areas. With the use of direct, repeated measures from the curriculum, there is continuity between the information collected during assessment and the information needed to evaluate instruction.

As Salvia and Ysseldyke (1981) pointed out, assessment is essentially the collection of data for the purpose of making decisions. The five decisions that they describe include screening/referral, eligibility, program planning, program evaluation, and outcome evaluation. The use of informal, curriculum-based measures during initial assessments in screening and eligibility avoids the inherent discontinuity in the data base that results when published, commercial tests are used. In this latter system, one type of information is collected initially, and then during instruction (program planning and evaluation), another type of information is generated and collected. Further, outcome evaluation using published tests is determined in a manner that is receiving increasing criticism (Jenkins & Pany, 1978; Skager, 1980). Finally, shifts in the measurement system preclude any meaningful analysis of the effects of educational decisions that were made.

In a related manner, the use of informal curriculum-based measures results in a system of assessment capable of adapting into a program of continuous evaluation. Because the materials involve minimal additional costs, are capable of providing multiple alternate

forms, and are time efficient to administer, the system can be implemented on a frequent, if not daily, basis. That is, assessment need not stop once instruction begins, but may continue throughout the entire educational program of the student.

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Table 1

Means and Standard Deviations on

Reading Measures for LD and NLD Students

Reading Measures	Learning Disabled $\bar{X}$	Learning Disabled S.D.	Non-Learning Disabled $\bar{X}$	Non-Learning Disabled S.D.
Direct Measures				
Word List - Words Read Correctly	32.2	16.2	53.3	26.4
Oral Passage - Words Read Correctly	39.8	26.4	94.0	33.5
Commercial Achievement Tests				
Peabody Individual Achievement Test (Total Percentile)	24.5	14.9	60.7	23.4
Stanford Diagnostic Reading Test (Total Percentile)	15.0	13.2	51.5	27.4
Discrepancy Scores				
Woodcock-Johnson Reading Aptitude - Reading Achievement	-8.6	15.1	-6.8	10.5

Table 2

Canonical Correlations and Classification Coefficients

Derived from Discriminant Analyses

Reading Measures	Canonical Correlations	Percentage Correctly Classified
Direct Measures (Word List and Oral Passage)	.63	83
Commercial Tests		
Achievement Measures (PIAT and SDRT)	.70	86
Discrepancy Score (Woodcock-Johnson)	.07	62

Table 3

Number and Percentage of Actual LD and NLD Students

Who Were Classified With Discriminant Analysis

Actual Group Classification	Predicted Group Classification	
	Number and Percentage of Students Classified as LD	Number and Percentage of Students Classified as NLD
Direct Measures (Word List and Oral Passage)		
Actual number of students classified as LD (N=14)	11 (81%)	3 (19%)
Actual number of students classified as NLD (N=21)	3 (14%)	18 (86%)
Commercial Achievement Tests (PIAT and SDRT)		
Actual number of students classified as LD (N=14)	13 (93%)	1 (7%)
Actual number of students classified as NLD (N=21)	4 (19%)	17 (81%)
Commercial Discrepancy Score (Woodcock-Johnson - Reading)		
Actual number of students classified as LD (N=25)	0 (0%)	25 (100%)
Actual number of students classified as NLD (N=40)	0 (0%)	40 (100%)

Table 4

Means and Standard Deviations on Written Expression Measures for LD and NLD Students

Written Expression Measures	Learning Disabled $\bar{X}$	Learning Disabled S.D.	Non-Learning Disabled $\bar{X}$	Non-Learning Disabled S.D.
Direct Measures				
Total Words Written	37.2	21.6	58.4	20.0
Words Spelled Correctly	30.8	21.1	53.4	20.5
Correct Letter Sequences	144.9	94.3	238.5	9'.6
Commercial Achievement Tests				
Test of Written Language (Scaled Subtest Scores)				
Vocabulary	7.3	4.3	11.2	3.4
Thematic Maturity	7.0	2.0	9.9	2.8
Spelling	5.2	2.7	10.3	3.6
Word Usage	5.1	2.6	10.9	3.6
Style	5.1	1.6	9.4	3.4
Discrepancy Scores				
Woodcock-Johnson Written Language Aptitude-Achievement	-15.6	15.2	-4.2	9.5

Table 5

Canonical Correlations and Classification Coefficients

Derived from Discriminant Analyses

Written Expression Measures	Canonical Correlations	Percentage Correctly Classified
Direct Measures		
(Total Words, Words Spelled Correctly and Correct Letter Sequences)	.52	73
Commercial Tests		
Achievement Measure (TOWL: All 5 subtests)	.68	80
Discrepancy Score (Woodcock-Johnson)	.43	74

Table 6

Number and Percentage of Actual LD and NLD Students

Who Were Classified with Discriminant Analysis

Actual Group Classification	Predicted Group Classification: Number and Percentage of Students Classified as LD	Predicted Group Classification: Number and Percentage of Students Classified as NLD
Direct Measures (Total Words, Words Spelled Correctly, Correct Letter Sequences)		
Actual number of students classified as LD (N=27)	14 (52%)	13 (48%)
Actual number of students classified as NLD (N=44)	6 (14%)	38 (86%)
Commercial Achievement Tests (Test of Written Language Subtests)		
Actual number of students classified as LD (N=31)	24 (77%)	7 (23%)
Actual number of students classified as NLD (N=51)	9 (18%)	42 (82%)
Commercial Discrepancy Score (Woodcock-Johnson: Written Language)		
Actual number of students classified as LD (N=23)	10 (43%)	13 (57%)
Actual number of students classified as NLD (N=39)	3 (7%)	36 (93%)

PUBLICATIONS

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